Illicit Discharge Screening Project
Annual Summary 2000

Prepared by
Clark County Public Works
Stormwater and Watershed Resources Section

December 2000

Table of Contents

Introduction

Clark County's National Pollutant Discharge Elimination System (NPDES) permit requires pollutant screening for stormwater outfalls and storm sewer lines as a basic monitoring (S5.B.4) and illicit discharge elimination tool (S5.B.g). Special condition S9.C.4 of the July 1999 permit called for Clark County to implement a screening project by July 31, 2000.

Overall goals for the project included the following:

1) Develop procedures for screening storm sewers and investigating potential pollutant sources
2) Revisit screening points which exhibited dry weather flow or possible illicit discharges in 1995 (during the Part 1 NPDES application).
3) Identify and screen for several types of illicit connections/discharges to the storm sewer system on a systematic basis.
4) Add data to the stormwater database and link results to existing GIS storm sewer maps.

Storm sewer screening is a preliminary tool that will not necessarily identify all illicit pollution sources. Since pollutant discharges to storm sewers are often brief or intermittent, screening will not identify many small periodic pollutant discharges from illicit connections, spills, dumping, or other activities. However, screening is likely to identify stormsewers having substantial or ongoing illicit discharge problems.

Field work for Clark County's illicit discharge screening program was initiated in August, 2000. The field season concluded Oct 31, 2000. A total of 109 sites were screened for illicit discharges, and 13 referrals were made for follow-up investigation of suspected illicit discharges.

Methods

<u>Illicit Discharges Defined</u>

According to the U.S. EPA, an illicit discharge is any discharge to a municipal separate storm sewer system that is not composed entirely of storm water. These may include inappropriate piped connections of waste lines to the storm sewer system, or a variety of inappropriate activities that result in waste products or wastewater entering storm sewer inlets. However, screening programs are <u>not</u> required to address or attempt to eliminate certain types of non-stormwater discharges, including the following:

Water line flushing	Discharges from potable water sources
Landscape irrigation	Foundation drains
Diverted stream flows	Air conditioning condensation
Rising ground waters	Irrigation water
Uncontaminated ground water infiltration	Springs
Uncontaminated pumped ground water	Water from crawl space pumps
Footing drains	Flows from riparian or wetland habitats
Lawn watering	Dechlorinated swimming pool water
Individual residential car washing	Street wash water

Screening Point Selection

During the initial sampling season, sampling was conducted in two stages. The first stage involved re-visiting selected screening points drawn from the results of the Phase I NPDES application screening project completed in 1995. Nearly 1000 storm sewer points were visited during the 1995 survey. Approximately 70 of those points had flow present at the time of sampling. Twenty-five of those 70 points lie in areas which have since been incorporated into city boundaries. The remaining 45 sites represented the initial sampling set for the current project.

After completion of the initial stage, a set of maps was produced by Clark County GIS to facilitate a systematic screening of the storm sewer system based on land use and existing storm sewer system data. The map set included all available information related to the storm sewer system, as well as sanitary sewer lines, quarter section lines, land use, topography, and water features.

Based on the above information, screening points were selected in each quarter section. In general, site selection focused on commercial/industrial areas and large residential areas with extensive storm drain systems. Commercial/industrial areas typically represent the greatest likelihood of illicit discharges, and therefore the highest priority was given to these areas.

Sampling Parameters

Sampling parameters were based primarily on the U.S. EPA 1993 Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems user's guide. The following list briefly describes the parameters included in the sampling program. Parameters marked with an asterisk (*) were recommended for inclusion by EPA. Additional parameters were also selected based on conversations with various agency staff involved with storm sewer screening projects in the Pacific northwest. Chemical parameters not analyzed by County staff were sent to North Creek Analytical Laboratories (NCA), in Beaverton, Oregon, for analysis.

Physical inspection:	Parameter	Method
	*estimated flow rate	field observation
	*odor	field observation
	*color	Hach color wheel (office)
	*turbidity	Hydrolab (in field)
	*temperature	Hydrolab (in field)
	*floatables	field observation
	*deposits/stains	field observation
	*vegetation	field observation
	*damage to outfall	field observation
Chemical/Biological	*conductivity	Hydrolab (in field)
	*total chlorine	kit (in office)
	*ammonia	NCA lab
	*pH	Hydrolab (in field)
	hardness	NCA lab
	copper	Hach test strip (in field)
	iron	Hach test strip (in field)
	fecal coliform	NCA lab

EPA states that the recommended physical parameters will likely be the most useful indicators of illicit discharges. Taken in combination, they can indicate the presence and often the degree of contaminated flows. Chemical parameters were included to supplement the physical inspection parameters, as follows:

conductivity	Used as an indicator of dissolved solids, and is also a general indicator of outfall contamination
hardness	Used to distinguish between natural and treated waters. EPA recommends testing for either fluoride or hardness.
total chlorine	Used to indicate potable water sources
ammonia	Used to indicate sanitary wastewater. EPA recommends testing for either potassium or ammonia.
pH	Extreme pH values may indicate commercial or industrial waste flows
copper	General indicator of metals contamination
iron	General indicator of metals contamination
fecal coliform	May indicate sanitary wastewater and can be a general indicator of public health risk

Copper, iron, and fecal coliform do not appear on the EPA recommended list. Copper and iron are used by the City of Portland as basic indicators of metal contamination. Portland staff recommended the use of test strips as an efficient initial testing method. Samples with positive test strip results were sent to NCA for analysis. Fecal coliform was included due to its common use in identifying potential public health risk.

Several EPA (or other) suggested parameters were NOT included in initial sampling, as follows:

surfactants	Surfactants are recommended by EPA as an indicator of detergent pollution. NCA is not equipped to perform this analysis, and very few labs are willing to perform the analysis due to cost considerations. Cost would be $50/each and samples would consistently be analyzed outside of hold time since no local laboratories would perform the analysis. Performing the test in-house would require an additional equipment purchase of ~$1000, plus substantial staff time to run the analyses.
potassium	Potassium is used to distinguish between sanitary and potable water. EPA recommends including either potassium or ammonia. Ammonia was chosen due to its more widespread use as a water quality indicator.
fluorescence	Fluorescence is recommended by EPA as an indicator of detergent pollution. NCA is not equipped to perform fluorescence testing, therefore additional equipment purchase

	(~$1000) would be required, plus substantial staff time to run the analyses.
fluoride	Fluoride is used to indicate potable water sources in areas where water supplies are fluoridated. Clark Public Utilities does not use fluoride, therefore the test would be irrelevant in most of unincorporated Clark County.
zinc	Zinc is routinely tested by the City of Portland's stormwater outfall program as an indicator of metals pollution. Zinc was used as a follow-up parameter at outfalls where metals contamination was suspected.
microtox screen	A microtox screen is used to evaluate relative toxicity. The cost is prohibitive for widespread use in this program ($127 each), but the test could be used for certain outfalls if other testing indicated a high likelihood of major toxic contamination.

Quality Control/Quality Assurance

NCA is a Washington Department of Ecology certified laboratory in Beaverton, Oregon. Laboratory QA/QC procedures were conducted according to NCA's approved QA/QC manual. Samples were collected in properly cleaned bottles supplied by the laboratory. Bottles were labeled in the field using waterproof markers with project name, site number, date, and time. Chain of custody documentation was prepared for each sample set.

Field equipment was calibrated prior to each sampling event as per manufacturer's instructions. Field data was recorded using waterproof pens and paper. Hydrolab data was recorded both digitally and manually.

Analyses for color, total chlorine, copper, and iron were conducted by County professional staff immediately upon returning from the field. Samples were analyzed according to the instructions accompanying each testing kit.

Field Methods

Prior to each field trip, proposed sampling sites were identified on field maps and a tentative route planned.

For safety reasons, two staff persons were present at each sample point. Staff wore orange safety vests at all times and utilized traffic cones when working in high-traffic areas. Safety issues were of paramount concern. At the discretion of sampling staff, pre-selected sampling sites could be modified or eliminated if on-site conditions were deemed unsafe.

Fluorescent orange paint was used to mark hard-to-find or potentially confusing sampling locations.

Two digital photographs were taken at each screening site where water samples were collected. These normally consisted of a general location photo and a second photo of the sampling point itself. No photographs were taken at sites with no flow or where samples could not be obtained.

Physical observations, water samples, and Hydrolab readings were collected at all sites having sufficient flow to enable sample collection. Appendix A is an example of the field data collection sheet used for this project.

Water samples were collected by one of three methods depending on site conditions: 1) direct immersion of sample bottles, 2) a long-handled sampling dipper, or 3) a small electric water pump. In some cases, a temporary check-dam was placed in the channel in order to create a pool deep enough to enable sampling. Water depth was often insufficient to enable in-situ use of the Hydrolab equipment. In these cases, water was collected in a bucket or with the long-handled dipper and the Hydrolab probe immersed in the container.

<u>Database/Site Ranking</u>

Screening data and associated site photos are stored in the NPDES database. A detailed description of the database functions can be found in a separate user's manual. The database can create reports for specific sites or site visits.

In addition, logic within the database provides ranks each site's recommended visit frequency according to the likelihood of illicit discharges. This provides a systematic means for checking higher risk sites more frequently than lower risk sites.

Appendix B shows a generalized schematic of the logic used by the database to rank sites. The goal of this logic is to ensure that the process of ranking sites is as objective as possible. The database analyzes the input data and decides on a rank of High, Medium, Low, or Omit. A user may override the computer generated rank based on professional judgement, but any such change will be documented in the database visit notes. Ranking is based primarily on the following factors: 1) presence or absence of flow, 2) surrounding land use, 3) site visit/laboratory data, and 4) professional staff judgement. Any site at which an illicit discharge is detected or suspected automatically receives a "high" ranking.

<u>Illicit Discharge Follow-up</u>

The illicit discharge detection program does not normally perform the follow-up investigations and technical assistance to eliminate illicit connections or discharges. Suspected problems are referred to Stormwater program Technical Assistance staff or to Clark County Code Enforcement for further action. Referrals and follow-up visits are recorded and tracked within the NPDES database.

Results

Staff visited 109 sites between August 1, 2000 and October 31, 2000. Water samples were collected at 38 of the 109 sites. Ten suspected illicit discharges were referred to follow-up staff based on field visit information or observations by field staff en route to selected screening points. Three additional sites were referred upon review of laboratory data.

Generally, the available literature suggests that approximately 10% of screening sites visited can be expected to show evidence of illicit connections or illicit discharges. The 13 referrals made in Clark County represent approximately 12% of the 109 sites visited. However, approximately one half of the referrals were based on chance observations of suspected problems by field staff, rather than on conditions found at an actual sampling point. Staff observations and water quality samples indicate that water at the majority of the sampled sites consisted primarily of uncontaminated flows.

The 13 referrals for suspected illicit connections or discharges included the following:

1) An auto repair shop disposing of shop waste and washwater into the storm drain.
2) An auto repair shop with improper disposal of leaking transmissions, among other problems.
3) An auto detail shop discharging soapy wash water into the storm drain.
4) Several manholes with oily, dirty water in the vicinity of a restaurant and an RV service center.
5) A mini-storage operation with evidence of wash-water discharge to a creek
6) A gas station which appeared to be discharging dirty water and sludge to the storm drain
7) A rental company discharging soapy wash water and cleaners into the storm drain
8) An industrial site possibly discharging contaminated process water into the storm drain
9) A culvert and ditch downstream from a commercial district with fecal coliform, sediment, ammonia, and chlorine all detected.
10) A golf course drain discharging colored water and ammonia to a creek.

These ten sites were referred to NPDES Technical Assistance staff for follow-up. The following three sites were referred to County Code Enforcement staff:

11) A large graded area immediately adjacent to a rural creek with no BMPs in place.
12) A residential subdivision with poorly maintained BMPs likely to discharge sediment to the storm drain.
13) Utility work in a residential subdivision resulting in erosion and sediment in the immediate vicinity of a storm drain and creek, with no BMPs in place.

Table 1 shows the number of sample sites exceeding state water quality standards or showing elevated levels of selected parameters (based on the 38 sites where water samples were collected). Criteria marked with an asterisk represent Washington Class A water quality standards. All other criteria were chosen to reflect the level of a given parameter felt to be indicative of possible problems.

Parameter	Criteria for Inclusion in Tally	Number of Sites
Temperature	>18 degrees C *	3
pH	<6.5 or >8.5 units *	0
Turbidity	>5 NTU over background *	1
Copper	present	1
Iron	present	14
Color	>30 Hach units	10
Total Chlorine	present	5
Ammonia	present	6
Fecal Coliform	>100 col/100 ml*	12
Odor	present	1
Clarity	other than clear	5
Floatables	present	1
Deposits/Stains	present	7
*indicates Washington Class A water quality standard		

Table 1. Number of sites meeting criteria for possible illicit discharges.

Based on ranking criteria and professional judgement, 39 sites were given a “High” re-visitation ranking. These sites will be re-visited during the summer 2001 sampling season. Of the remaining sites, 15 received a “Medium” ranking, 27 received a “Low” ranking, and 28 received an “Omit” ranking. Sites with “Medium” or “Low” rankings will be re-visited in 2002 or 2003, respectively, as funding and staff availability allow.

Full results from individual sites may be found in the NPDES database.

Future Program Modifications

Screening project field activities will resume during the 2001 dry season (approximately June-September). Systematic screening of previously unvisited quarter-sections will continue, focusing on urban and urbanizing areas. As noted, sites ranked as “High” with regard to re-visitation frequency during 2000 will also be re-checked in 2001.

Traffic Safety

Traffic cones are necessary at many sampling sites due to traffic volume. It is recommended that safety instruction be provided to all staff, permanent or temporary, who will be engaged in field work for the illicit discharge detection program.

Sampling Parameter Changes

Based on results from the initial year of sampling, several modifications will be made to the list of sampled parameters, as follows:

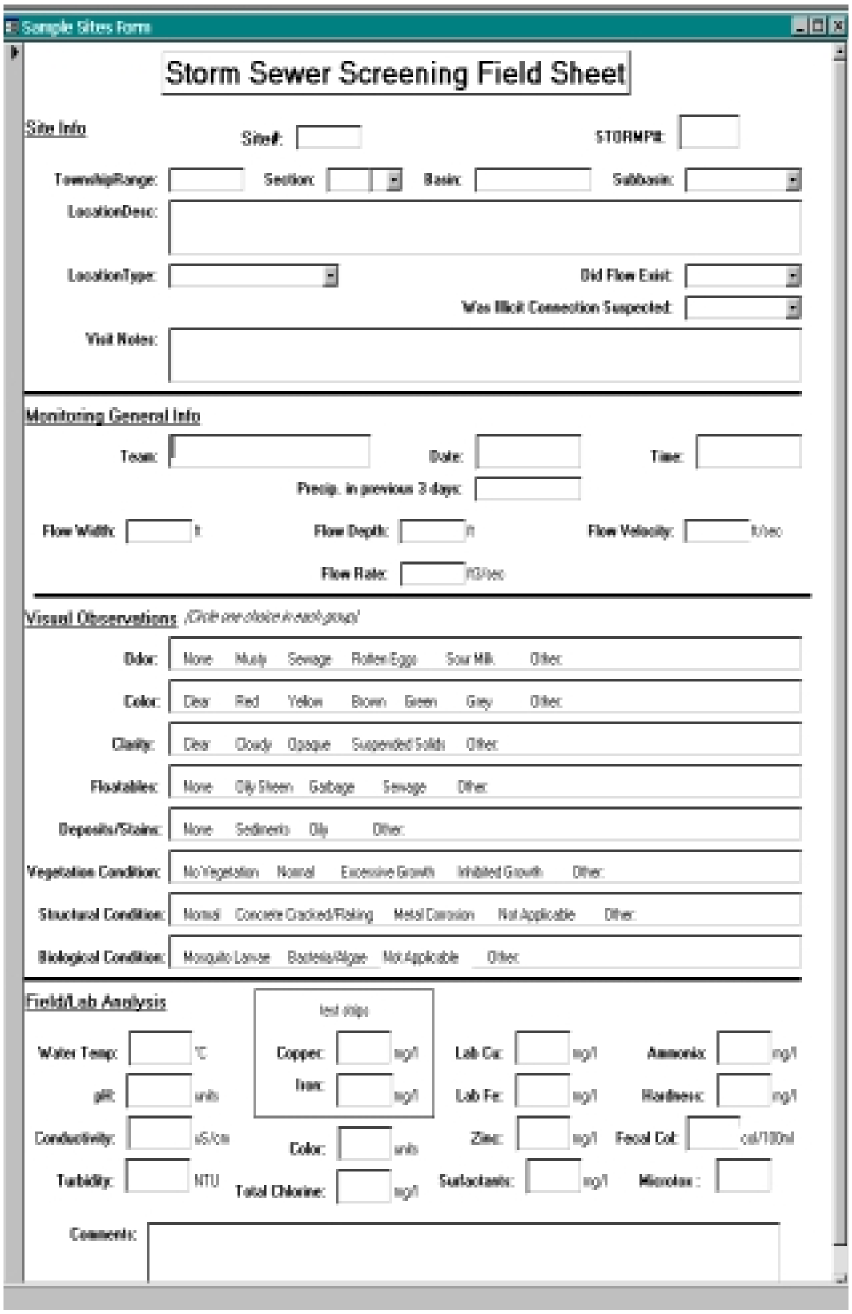
1) Total Chlorine will no longer be analyzed by staff using a Hach kit. The kits have not proven sensitive enough to detect chlorine at levels commonly found in illicit discharges. Samples will be collected in specialized bottles and analyzed at NCA.
2) Hardness will no longer be analyzed. Hardness values from the initial season correlated very highly with conductivity. Due to this correlation, hardness analysis does not appear to represent an efficient use of limited analysis dollars.
3) Copper will no longer be analyzed by staff with test strips. The strips have not proven sensitive enough to detect copper at levels commonly found in illicit discharges. Samples will be sent to NCA for analysis.
4) Iron will no longer be analyzed. Positive tests for iron during the initial season were almost exclusively associated with the presence of orange iron-bacteria. This is easily assessed visually, and does not generally indicate an illicit connection.
5) Fecal coliform will no longer be analyzed. E. coli and enterococci have been shown to be more reliable indicators of pathogenic organisms. Recent reductions in per sample analysis costs have made E. coli or enterococci testing financially viable. E. coli or enterococci will therefore replace fecal coliform.
6) Zinc will replace iron as a standard test for all samples because it is more commonly analyzed as a storm-water and illicit discharge pollutant. Samples will be sent to NCA for analysis.
7) Detergent (surfactant) testing will be further evaluated as a testing parameter. Recent literature further supports the use of detergents as a reliable indicator of illicit discharges. Further attempts will be made to find a practical means to add this parameter.

It is not anticipated that these changes will affect the overall project budget.

Site Flagging

Site marking or flagging did not follow a consistent pattern during the initial sampling season. In future years, a consistent marking pattern should be used at all sample sites.

APPENDICES



Sample Sites Form

Storm Sewer Screening Field Sheet

Site Info

Site#:

STORMPI#:

Township/Range: Section: Basin: Subbasin:

LocationDesc:

LocationType:

Did Flow Exist:

Was Illicit Connection Suspected:

Visit Notes:

Monitoring General Info

Team: Date: Time:

Precip. in previous 3 days:

Flow Width: ft Flow Depth: ft Flow Velocity: ft/sec

Flow Rate: ft3/sec

Visual Observations *(Circle one choice in each group)*

Odor: None Musty Sewage Rotten Eggs Sour Milk Other:

Color: Clear Red Yellow Brown Green Grey Other:

Clarity: Clear Cloudy Opaque Suspended Solids Other:

Floatables: None Oily Sheen Garbage Sewage Other:

Deposits/Stains: None Sediments Oily Other:

Vegetation Condition: No Vegetation Normal Excessive Growth Inhibited Growth Other:

Structural Condition: Normal Concrete Cracked/Flaking Metal Corrosion Not Applicable Other:

Biological Condition: Mosquito Larvae Bacteria/Algae Not Applicable Other:

Field/Lab Analysis

test strips

Water Temp: °C Copper: mg/l Lab Cu: mg/l Ammonia: mg/l

pH: units Iron: mg/l Lab Fe: mg/l Hardness: mg/l

Conductivity: uS/cm Color: units Zinc: mg/l Fecal Col: col/100ml

Turbidity: NTU Total Chlorine: mg/l Surfactants: mg/l Microtox:

Comments:

Appendix A: Example field sheet

	"Landuse"		"Flow Rate (cfs)"		"Receiving Body Visual Obs"		
If	Commercial/Industrial	and	flow > 0			then	HIGH
If	Commercial/Industrial	and	no flow	and	flow = "standing water" condition = "dirty"	then	HIGH
If	Commercial/Industrial	and	no flow	and	flow = "no flow" condition = "dirty"	then	MEDIUM
If	Commercial/Industrial	and	no flow	and	flow = "standing water" condition = "clean"	then	MEDIUM
If	Commercial/Industrial	and	no flow	and	flow = "no flow" condition = "clean"	then	LOW
If	Residential	and	flow > 0	and	condition = "dirty"	then	HIGH
If	Residential	and	flow > 0	and	condition = "clean"	then	MEDIUM
If	Residential	and	no flow	and	flow = "standing water" condition = "dirty"	then	MEDIUM
If	Residential	and	no flow	and	flow = "standing water" condition = "clean"	then	LOW
If	Residential	and	no flow	and	flow = "no flow" condition = "dirty"	then	LOW
If	Residential	and	no flow	and	flow = "no flow" condition = "clean"	then	OMIT

Rural = same set of conditions as "Residential" above

Appendix B: Database logic used to rank screening points for future visit frequency

Additional triggers: Any of the following automatically result in a HIGH ranking, regardless of land use and flow.

Cell:	**Trigger:**
Is illicit connection suspected?	yes response
Water temp	> 18
pH	< 6.5 or > 8.0
Conductivity	> 350
turbidity	> 20
copper strip	no trigger
iron strip	no trigger
color	> 30
total chlorine	> 0
copper (lab)	> 0
iron (lab)	no trigger
zinc	> 0
surfactants	> 0
ammonia	> 0
hardness	no trigger
fecal coliform	> 100
microtox	no trigger

Appendix B continued: Database logic used to rank screening points for future visit frequency.